THE ECONOMIC APPROACH TO RESOURCE DEVELOPMENT IN NEW ZEALAND

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> Nothing amuses more harmlessly than computation and nothing is more applicable to real business or speculative enquiries. A thousand stories which the ignorant tell or believe die away at once when the computist takes them in his grasp.
>
> —*Samuel Johnson*

Nowadays perhaps we should read computer for computist.

The purpose of this paper is to draw attention to the economic aspects of resource development and to suggest the need for the overall planning of development in New Zealand, and for a more systematic approach to the assessment of individual projects. This will necessitate the use of some of the recently developed techniques of applied economics or operational research. As a background, it is necessary to draw attention to two significant changes which have taken place in the economic philosophy of the Western world during the last decade and which will probably influence New Zealand's political economy during the next. These are the concepts of economic growth and of indicative planning.

There is a fashion in economic theories and philosophies, just as there is in more tangible things. At the end of the second World War, maintenance of full employment was the first priority and there was widespread agreement that a return to the depression of the 'thirties was inadmissible. Fortunately, the general acceptance of Keynesian economics meant that governments were provided with the economic weapons which made possible the achievement of this aim. Hardly had this been fully appreciated however, before it became apparent that control of inflation would be the major problem of the late 'forties and early 'fifties, together with the associated balance of payment problems for major trading nations. Although the problem of inflation has not been solved entirely, the general attitude towards it has changed and it has now been tacitly accepted that a mild degree of inflation is an almost inevitable concomitant of policies of full employment. In its turn economic growth has become *the* major consideration and politicians and civil servants are almost as voluble as economists in their discussion of changes in GNP (gross national product) and in the position their country occupies in the world league tables that are produced by the statistical economists.

Economic Growth

The second major change has been the widespread acknowledgment that the rate of economic growth is likely to be more satisfactory if it is planned nationally on broad lines and not left to the whims of private firms or public corporations pursuing their own investment programmes without any reference to their overall effect upon the national economy. The concept and nature of planning has changed in Western countries during the last decade. The emphasis on detailed physical planning, which was in vogue during the early years of reconstruction, has been replaced by a much broader and flexible concept which has come to be known as 'indicative planning'. Under this system, a central planning agency postulates a desirable rate of economic growth, expressed in terms of a compound percentage increase in GNP, and analyses the implications of this rate for the various sectors of the economy. State organisations and private firms within the sectors then design

their own investment, production and sales programmes within the broad outlines of the national plan. Successful planning on these lines has been both aided by, and has in turn stimulated, the development of new techniques of operational economics—linear programming, cost-benefit analysis, sector accounting, process analysis, etc., which have made remarkable strides in recent years assisted materially by the electronic computer. The operation of this type of planning, co-ordinated with supporting monetary and fiscal policy, has been a major factor in the striking growth rates achieved by Japan and France in recent years.

Concurrently with the development of these operational tools the resurgence of interest in economic growth has been accompanied by a proliferation of economic theory in this field and the growth models of Harrod, Domar, Dusenberry and others have become the focal point of discussion in advanced economic theory. Much of the discussion in recent years has centred on the choice of investment criteria and on their application to the growth of underdeveloped countries.

To what extent have these ideas and techniques permeated the scene in New Zealand? Only two or three years ago, there was little general awareness of the need for economic growth in this country. Fortunate in possessing a high standard of living with little inequality of income, New Zealanders appeared unaware of the rapid changes that were taking place in other Western countries. The impact upon the economy of the unfavourable change in the terms of trade during the late 'fifties and early 'sixties, and the incipient crisis at the time of Britain's application to join the European Economic Community, led to a more critical appraisal of our economic situation and to a general recognition of the poor growth performance of New Zealand in comparison with other countries.[1] It also became painfully clear that the country was living on a hand to mouth basis with little or no formalised economic policy. Indeed, to the visitor from overseas it sometimes appears that New Zealand has achieved a position where she gets the worst of both worlds. We have no systematic economic planning but the economy is still hampered by a multitude of controls and regulations—import control, price control, currency control, licensing measures of various kinds—which many other Western countries sloughed off in the 'fifties.

Recent Moves in New Zealand

Despite this litter of an earlier form of planning there was, until very recently, no recognition of the need for indicative planning, but in the last year we have seen a tentative move in this direction. The present government has made a cautious reference to the need for an overall plan and a target rate of a four percent rise in GNP has been discretely discussed in some quarters. This is the basis of the projection set out in the Agricultural Development Conference which is the first exercise of this kind carried out in New Zealand. Since this probably foreshadows future events it may be worthwhile outlining the nature of the approach.

1 The Treasury has taken the Government Statistician's projection of population which, (assuming an immigration rate of 10,000 annually) gives an estimated population of just over three million in 1973.

2 A target growth rate of GNP of four percent per annum over the decade has been set. Assuming no deterioration in our terms of trade and allowing for population growth, this means an annual rise in real income per head or standard of living of two percent. This is well behind the achievements of some other countries in recent years but it is better than we have managed over the last decade.

3 On the basis of these projections it has been calculated that by 1972-1973 our requirements for visible imports would reach £369 million compared with £254 million in 1962-1963, valued at constant prices: a rise of 45 percent over the decade.

4 Our deficit on 'invisibles' in the balance of payments is also likely to rise rapidly, reaching £138 million by 1972-1973.

5 To meet these requirements for visible and invisible imports the value of exports will need to rise from £300 million in 1962-1963 to £467 million by 1972-1973, a compound rise of 4½ percent per annum.

6 Assuming that £27 million of this increase could be met by the non pastoral industries—forestry, horticulture, manufacturing—the pastoral industries would be called upon to increase exports by £140 million, a 4.1 percent compound increase over the decade.

7 The next step in the plan, which is currently being discussed in the various Agricultural Development Conference Committees, is to estimate the level of agricultural production necessary to meet this export target and then to analyse ways and means of achieving it.

Much of the results of the numerous working committees into which the Conference was devolved will inevitably take the form of inspired guesses, or even sectional compromises, because most of the basic research on the economic and technical relationships involved has not been carried out. Some of the detailed research is now being started at the Agricultural Economics Research Unit which was recently established at Lincoln College under the directorship of Professor R. P. Philpott. The Unit, which is financed from D.S.I.R. funds, is concentrating on production, marketing and inter-sector problems in co-operation with the departments concerned.

Planning on a national scale requires a macro-economic planning apparatus which is still totally lacking in this country. It is not my purpose to examine planning of this nature. An admirable discussion of its features and merits was given recently by Professor Holmes.[2] Overseas experience does however suggest that the adoption of indicative planning and the establishment of a competent organisation for this purpose would be a major step towards solving some of the critical problems that will face this country in the next decade.

Although we have no overall plan we have, true to the national philosophy of preferring the concrete to the abstract, produced an impressive list of large scale development projects, some of which have already been embarked upon while others are still in the embryonic stage. These include major projects in agriculture, industry, forestry, transport and communications, education and other social fields, and we must also envisage a considerable further expansion of many smaller private industrial schemes.

In most countries, especially one as small as New Zealand, the ultimate decision for major development projects will always be political in nature. They will however be more informed, and it is to be hoped, better decisions, if a systematic and objective way of evaluating the individual projects is established. It is with this aspect of development that I am myself primarily concerned.[3] It may be noted in passing that the evaluation of specific projects on an 'economic engineering' basis is essential for implementing a development plan.

Cost-benefit Analysis

The method suggested for evaluating individual projects is cost-benefit analysis. This is an operational technique which has attracted an increasing amount of attention over the last twenty years following its use by U.S.A. government agencies for evaluating water resource projects and river basin development plans. Eckstein[4], Krutilla[5] and other writers have discussed the practices employed and an inter-agency handbook has been prepared for formalising this type of analysis.[6] It is relevant to note that no project of this nature is considered for federal financial assistance in the United States unless the proposal is accompanied by an economic report containing a detailed cost-benefit analysis.

This method of analysis is now being applied to a wide range of projects in other overseas countries including transport (the proposed Cross Channel Tunnel is an interesting example), communications, weapons systems, town and regional planning, etc. The framework for thorough and systematic evaluation which cost-benefit analysis provides makes it particularly suited to this country where most of the major development projects: power, transport, land develop-

ment for agriculture or forestry, are controlled by the government. Even in those industries where the government is not directly involved, the existence of import control, price control, etc., means that a very large part of our economic activity is not subject to free market forces. As such, the allocation of natural resources through the price system is unlikely to achieve optimum economic growth and it is precisely in this situation, where extra-market forces are of major consideration, that cost-benefit analysis is applicable. It is particularly designed to take into account the social costs and benefits of development which are omitted from the profit and loss account of a private firm, or even a state organisation controlled on traditional lines.

Some of these social benefits and costs will be amenable to quantitative measurement and so can be incorporated into a planning balance sheet[7]. This is true of a greater range of elements than was previously realised. Others such as national prestige, scenic beauty, social preference, equity and so on are likely to remain as true 'intangibles'. This does not mean however that they can not be included in a cost-benefit study. A consideration of intangibles and an attempt to relate any social cost of this nature to measurable gains is an essential part of the analysis. For example, we cannot measure the loss of welfare which would result if the level of Lake Manapouri were raised; but we *can* measure the net effect upon the proposed development scheme if the level is not raised. This would provide a measure of the cost of conservation and so help to make a more rational choice possible.

Cost-benefit analysis is usually conducted from a national or regional point of view; it requires a clear identification of the main objective and a review of alternative ways of achieving it followed by a detailed economic analysis according to some socially desirable criterion. The criterion adopted is the relation between total costs and total benefits, both expressed in terms of present values, or annual equivalents, by the use of compound interest techniques. These techniques are necessary because the spread of capital costs over a development period, and the fact that annual costs and returns are unlikely to be uniform over time, invalidates the use of apparently simpler concepts, such as the accountant's rate of return on capital or capital intensity.

The relationship between benefits and costs is frequently expressed as a ratio, i.e. V/C (notably in much American river development work) but for more general analysis the more suitable criterion is the maximisation of net benefit i.e. V—C. This has the operational merit that it takes into account the scale of investment as well as its efficiency and, as such, it records the net contribution made by the project to the economy. Following this terminology we may designate V—C as the *social present worth of the project (SPW)*. For the moment discussion will be deferred of the time element and it will be assumed that all cost and benefits are expressed in terms of present values. A closed economy is also assumed.

We may then take as our basic equation

$$SPW=(V_1 + V_2) - (C_1 + C_2) \qquad \text{——— (1)}$$

where,

V_1–value of direct benefits i.e. increased *consumption* of product on domestic market, valued at import prices with the effect of taxes, tariffs and subsidies eliminated.

V_2–value of indirect benefits, internal economies including any reduction in costs to other domestic producers.

C_1–domestic operating and development costs of labour and materials. These should be valued at their opportunity cost i.e. where there exists unemployment or under-employment of domestic resources they should be accorded 'shadow' prices reflecting their marginal productivities rather than their actual market prices.

C_2–indirect domestic costs; any external diseconomies occasioned by the project to other producers in the same sector or other sectors of the economy.

The measurement of indirect benefits and costs is a matter of some complexity. In some cases they may be readily identifiable and measurable

(e.g. off site benefits in soil conservation). Other cases involve inter-relationships between the sector in which the development takes place and other sectors of the economy, for example large scale agricultural development will incur 'linkage effects' with the fertiliser industry and meat processing industry. The analysis of this group of indirect benefits and costs for a large project will require an inter-sector analysis but for a small project the effects may be approximated by the use of existing 'value added' measures.

In addition to primary effects (both direct and indirect) an investment project will have secondary effects upon the economy. It is customary to ignore these unless there is a state of unemployment when multiplier consumption and employment effects should be included in the analysis via a social accounting study.

Application of Cost-benefit Analysis

A list of development projects in New Zealand to which cost-benefit analysis could be applied is given below; it is meant to be illustrative rather than exhaustive in nature.

Aluminium industry at Bluff
Manapouri hydroelectric scheme
Sugar beet industry in South Otago
Development of the Mackenzie Country
Large scale land development for agriculture and for forestry
Pulp industry in Nelson
Expansion of the fishing industry
Large scale conservation projects
The Tongariro power scheme
Urban development
Steel industry based on iron sands of North Island
Transport development: airways, roads, ferry services (the Lyttelton road tunnel and the Aramoana ferry service would provide excellent examples)

Inspection of this list shows that the effects of some projects such as urban development would be primarily internal but that most of the others, and also secondary industries established for import replacement, would have major effects upon our overseas trading position. To analyse this aspect of development it is necessary to drop the assumption of a closed economy and to incorporate a balance of trade factor into our basic equation.

$$SPW=(V_1 + V_2) - (C_1 + C_2) + (X-M) \qquad \text{.....(2)}$$

where

X–increased earnings of foreign currency or savings of foreign currency due to import replacement,

M–increased expenditure of foreign currency for capital installation and operating costs, i.e. materials, spare parts, etc.

In calculating X and M allowance should be made for indirect and secondary effects; as these are likely to be smaller in nature than for V and C they have not been designated separately.

Where there exists a balance of trade equilibrium, overseas benefits and costs may be regarded as directly comparable with domestic ones but where, as with New Zealand, there is a chronic imbalance of trade, they require discriminatory treatment, that is to say some allowance must be made for the fact that overseas currency has a higher value than the existing exchange rate indicates. We require a criterion which takes this aspect into account. I suggest this may be done by incorporating a premium for foreign exchange into the cost-benefit equation.

$$SPW=(V_1 + V_2) - (C_1 + C_2) + a(X - M) \qquad \text{.....(3)}$$

The premium a will be an arbitrary value approximating the value to which the local currency is overvalued i.e. if it is assumed that the New Zealand pound is overvalued by 10 percent then a would be 1.1, if by 25 per cent then a would be 1.25. The higher the value given to a the greater the weighting

given to projects designed for import replacement or for increasing exports. This 'shadow price' for foreign currency should approximate the equilibrium rate of exchange; this could conceivably be determined by detailed linear programming studies using overseas currency as a major constraint but in their absence it would have to be estimated intuitively.

An unofficial exchange rate for overseas currencies has long been recognised in New Zealand by the private individual who currently pays a premium of five percent on the stock market for British or Australian securities, and of around 20 percent in order to get hold of a new car without sterling funds. It has also of course been recognised nationally by governments which have encouraged the development of secondary industries. Indeed, I believe that it has been overstressed and that many industrial projects have been encouraged on the vague grounds of import replacement with little regard for their effect upon the internal costs or the allocation of domestic resources involved.

One way of measuring the social worth of an import replacement scheme would be in terms of the premium value such a scheme placed upon overseas exchange. This could be determined by rearrangment of our last equation. Instead of putting a planning value of a into the equation we could determine its break-even value by setting SPW to zero. In other words we make the assumption that the project is just worthwhile at the exchange rate which is thrown up by our calculation. For illustration I shall ignore indirect effects.

$$SPW = V - C + a(X - M) \qquad \text{..... (4)}$$

Now set SPW to zero, and note that V–increased consumption on the domestic market–will also be zero if we assume that the additional production simply replaces goods previously imported.

Solving equation (4) for a we have

$$a = \frac{C}{X - M} \qquad \text{.....(5)}$$

It will be seen that this gives an expression for the ratio of domestic costs to net overseas costs. In this form it provides an alternative way of expressing our planning criterion. We could decree that only those projects which had a break-even value of less than 1.X should be allowed to develop. An analysis of this nature would give us an estimate of the real cost in terms of domestic resources occasioned by secondary development and I would like to suggest that such exercises should be carried out before import replacement industries are set up; the analysis might even be applied to existing industries such as a glass works or a bicycle factory.

Alan Frampton of Lincoln College has made use of this concept in a study he has just completed of the potential sugar beet industry in New Zealand.[9] The results, summarised below, (Table I) are based on a range of assumptions of sugar import prices and of the probable requirements of foreign exchange for plant, machinery, etc. The premium values are given in the body of the table.

Table I

Sugar Beet

Assumed average world raw sugar price (£/long ton)	Estimated inputs of foreign exchange £5 million	£6 million	£7 million	£8 million
32.35[1]	1.51	1.54	1.58	1.61
37.35[2]	1.29	1.31	1.34	1.36
42.35[3]	1.12	1.14	1.16	1.18

1 Average world price (London) 1953-1962.
2 Average New Zealand import price 1954-1963 including the high price of 1963.
3 A high price only likely in occasional years.

The results indicate that under the most favourable assumptions import replacement for some sugar would cost £NZ1.12 for each £1 saved. Under the least favourable assumptions this premium would rise to £NZ1.61 for £1. The most probable value would appear to be between £NZ1.3-£NZ1.5 for £1.

The application of cost-benefit analysis

Many development projects in New Zealand appear to be undertaken without a systematic analysis of even the primary costs and benefits involved; to tackle just this first stage empirically would seem to me to be a large step forward. An analysis of indirect and secondary effects and of intangibles could then be introduced on this framework, although the collection of adequate data is likely to prove even more difficult than for the primary effects. This type of analysis would require co-operation between the economists and technical experts; agriculturalists, foresters, surveyors, civil engineers, traffic engineers, geographers, town planners, etc. I believe that it is unfortunately true to say that the necessity for this type of co-operation has hardly been recognised in this country. The fault lies on both sides. Many technical experts appear to be unaware that there is an economic aspect to all their problems and that economic analysis and techniques are essential to their correct solution. Equally, many economists have paid far too little attention to applied problems. This situation has changed rapidly overseas with the startling strides taken by operational economics in recent years ,and surely we are ripe for such a change in New Zealand.

This is not the place to give a detailed account of a cost-benefit analysis but a broad outline might be appropriate. The analysis of any development proposal necessitates projections of benefits and costs which are best handled in the form of development budgets. The budgets should initially be composed in a quantitative physical form, that is input of material and labour, both for development and for operation, and output of products. Obtaining the correct technical co-efficients is absolutely fundamental to the study. When the technical budget has been drawn up it is transposed into financial terms by applying prices for input and output. Historical data should not be used for this purpose as projections of the future are required.

Three possible procedures may be considered:

1 Recent trends may be projected into the future.

2 Forecasts of future values may be used, based upon econometric studies of recent trends, income and price elasticities of demand and the rate of technical change in specific industries. This type of analysis is being carried out for New Zealand's primary exports by Professor Philpott at Lincoln College.

3 Instead of using forecasts of a future value a range of values may be written into the programme. This process throws light upon the stability of the result and its sensitivity to changes in critical variables. Sophisticated models incorporate a probability analysis in which single values are weighted according to the probability of the outcome.

Whichever method is used it has to be acknowledged that the likelihood of error due to the uncertainty of the future is clearly large.

At this stage the budget will represent streams of benefits and costs over time. The flow of benefits takes the form of gross output usually commencing some time after the initial capital input and continuing for a varying period into the future, while that of costs typically consists of a heavy initial investment and a flow of operating costs. In order to bring these benefits and costs onto a comparable basis, techniques involving compound interest are used. The rationale of compound interest is that any specific project ties up the nation's resources (for example in growing forests or land development) when they could have been used for alternative investments yielding a more immediate production stream.

A number of approaches involving compound interest techniques are possible. The one usually adopted is to discount all future benefits and costs to their present worth using a selected (social) rate of interest and so obtain V—C directly. A variation is to compound costs and benefits forward to a predetermined investment horizon and then to calculate the net benefit at that time and discount this single value to the present. This method has the advantage that it provides a capital profile for the development plan. An alternative approach is to solve the streams of future benefits and costs for the internal rate of return but this raises a number of theoretical and practical problems which will not be considered further here.

With the aid of grants provided by D.S.I.R. and the New Zealand Forest Service, and with the co-operation of a number of other government departments, the Agricultural Economics Research Unit at Lincoln College is at present making cost-benefit studies of land development for agriculture and forestry and we are shortly to extend its use for research in conservation, irrigation and other developments in the primary sector. With data provided by the Department of Lands and Survey we are making an analysis of agricultural development of the Maraetai Block of 25,000 acres in the Bay of Plenty. The programme extends over 30 years to allow for primary and secondary development; the technical coefficients are based on the actual development of the block carried out over the period 1949 to 1961 but a set of future prices, ranging from pessimistic to optimistic, has been built into the programme. Using five different interest rates we obtain a three by five matrix of V—C's which may be called the 'land expectation values' for agriculture. In general terms these indicate the price agriculture could afford to pay for the land, according to the assumptions made. Members of the Forest Service are making a similar projection for a forestry regime, based on physical results for a neighbouring plantation. This is being analysed in the same way. The analysis is being carried out by programming the development budgets for the IBM 1620 computer of the University of Canterbury.

Although large scale development of this type attracts attention, the breaking of new land can only provide a fraction of the increase in agricultural production required to meet our development target; indeed it will probably be insufficient to offset the loss of farm land to urban purposes and to forestry whose claims will become larger with the growth of our community. The great proportion of the increase must come from intensifying production from land already farmed. With this idea in mind Lincoln College, in association with the Department of Agriculture, is also beginning a study of private land development concentrated at present on the hill country of the North Island and (later) the down country of the South Island. The purpose of the study is to estimate the returns to the nation, and to the individual property owner, from developing this class of land and at the same time to discover whether social or institutional barriers to development exist if the economic results are found to be favourable.

Conclusions

In conclusion I should like to repeat my main theme. First, the development of New Zealand's resources should not proceed piecemeal but should be set within a growth plan which should be indicative rather than coercive in nature. This would require the setting up of a National Planning Council.

Second, individual projects proposed for inclusion in the overall plan should be assessed on a systematic and objective basis. This would require the establishment of a Project Evaluation Unit capable of analysing the economic and technical aspects of a project. There would be no lack of problems for either body to tackle: the difficulty would be in finding the trained staff to do the work. It would be fatal to assume that the Unit could be staffed by wellmeaning amateurs; we require trained professionals.

There will of course be those who say that New Zealand cannot afford planning of this type. The answer to them is surely that if we reflect on the need

for the future development of our national resources and consider the results achieved by other countries which are using these methods we cannot afford *not* to have it.

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